

ON THE
INFLAMMATORY DISEASES OF THE
KIDNEY.

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IN a paper published in the last volume of the Society's Transactions I gave some account of fatty degeneration of the kidney, and declared my intention to make the inflammatory diseases the subject of a separate communication. On the present occasion I purpose to bring before the Society the result of some observations on this very interesting and important subject.

The inflammatory diseases of the kidney may be arranged in two distinct classes: — the first class including those diseases which are the result of some local cause—such as retention of the urine in consequence of stricture, the mechanical irritation of a stone, or a blow on the loins: while in the second class are included those diseases which are the result of a constitutional cause, or, to speak more precisely, of some abnormal condition of the blood. The latter class of diseases is by far the most important, and it is this class only which will be treated of in the present communication.

In the paper before alluded to, when referring to the condition of the kidney which occurs as a consequence of scarlatina, I stated that “it is in fact an inflammation of the kid-

ney, excited like the inflammation of the skin which constitutes the eruption of scarlatina, by the passage through the part of the peculiar fever poison; and, as the inflammation of the skin terminates in an excessive development of epidermis and a desquamation of the surface, so the inflammation of the kidney excites an increased development of the epithelium which lines the urinary tubules: this material partly accumulates in and chokes up the tubes, while part of it becomes washed out with the urine, and may be detected in large quantities in that fluid by the aid of the microscope."

To the account then given, which I believe to be essentially correct, subsequent observations enable me to make some important additions. The appearance of the kidney in these cases is admirably represented in a drawing which was made for me by Dr. Westmacott.* The kidney was taken from a girl who died in a few days after symptoms of renal disease had manifested themselves. The gland is enlarged, apparently by the deposit of a white material in the cortical substance: the vessels in the cortical portion, where they are not compressed by this new material, are injected and of a bright red hue; the pyramidal portions are of a dark red colour, in consequence of the large veins which occupy these portions of the gland being distended with blood. The appearance of the entire organ is quite that of a part in a state of acute inflammation.

When the kidney has been in a softened condition before the occurrence of the inflammatory disease, as often happens in elderly persons, the lobules on the surface appear larger and coarser than natural; the veins, being less compressed than when the natural texture of the kidney is firmer and more unyielding, are much distended with blood, so that the entire organ is of a dark slate colour. (Dr. Bright's fifth plate represents a kidney in this condition.)

On a microscopical examination, the convoluted tubes are

* The drawings referred to here and elsewhere in this communication were exhibited at the meeting, and are now in the possession of the author.

seen filled in different degrees with nucleated cells, differing in no essential character from those which line the tubes of the healthy gland. The chief difference between these cells which are the product of inflammation, and those which exist in health, consists in the former being generally of smaller size and more opaque and dense in their texture. It is very interesting and important to observe that, while the convoluted tubes are rendered opaque by this accumulation of cells in their interior, the Malpighian bodies are transparent and apparently quite healthy. (See Plate VI. fig. 1.) The straight tubes which form the pyramids also contain an increased number of cells, but there is reason to believe that these cells are not formed in these portions of the tubes, but that they are lodged there in their passage from the convoluted through the straight tubes, the latter being merely ducts leading into the pelvis of the kidney. Some of the tubes contain blood, which has doubtless escaped from the gorged Malpighian vessels lying within the dilated extremities of the tubes. There is no deposit outside the tubes. The essential changes in the kidney are an increased fulness of the blood-vessels, and an abundant development of epithelial cells, differing slightly in general appearance, size, and consistence, from the normal renal cells; this increased cell-development occurring in those portions of the urinary tubules, the office of which, as Mr. Bowman has suggested, is to excrete the peculiar saline constituents of the urine, while the Malpighian bodies, whose office is the separation of the water, are unaffected.*

* I may here mention an observation which is interesting in connection with the pathology of nephritis, and which affords additional evidence as to the accuracy of Mr. Bowman's theory. Within the last few months I have examined the kidneys of two persons who died jaundiced, and in whose urine there had been a large quantity of bile. Many of the urinary tubes were stained of a deep yellow colour by the bile in their epithelial cells. This yellow colour ceased abruptly at the neck of the Malpighian bodies, and in no instance did I observe it in the Malpighian bodies themselves.

The condition of the urine in these cases is clearly indicative of the changes occurring in the kidney. After the urine has been allowed to stand for a short time a sediment forms, and on placing a portion of this under the microscope, there may be seen blood-corpuscles, with epithelial cells in great numbers, partly free and partly entangled in cylindrical fibrinous casts of the urinary tubes;* and very commonly numerous crystals of lithic acid are present. (See Plate VI. fig. 7.) As the disease subsides, which under proper treatment it usually does in a few days, the blood, fibrinous casts and epithelial cells diminish in quantity, and finally disappear; but traces of the casts and cells are still visible, some days after the urine has ceased to coagulate on the application of heat or nitric acid.

The casts and cells, which appear in the urine when the disease is subsiding, are such as have remained some time in the urinary tubes before they have become washed out by the current of fluid poured into the tubes from the Malpighian bodies: many of the cells entangled in these casts have, consequently, become disintegrated and broken up into amorphous granular masses, thus presenting appearances which I shall presently show are characteristic of the casts occurring in cases of chronic nephritis. Such is the morbid anatomy of the kidney, and such are the characters of the urine occurring as a consequence of scarlatina.

The present state of physiological science enables us to give a sufficiently satisfactory explanation of these phenomena. It is now a well-known and well-established fact, that all secretion is performed by the agency of nucleated cells,—cells which, in process of growth and development, abstract certain materials from the blood, which materials constitute the secretions of the various glands. While there is a certain general *resemblance* between the cells of all true glands, there are also certain well-marked *differences* between the cells of different glands. For example, the hepatic and

* These fibrinous casts of the tubes were first observed in the urine by Dr. J. Franz Simon.

the renal cells have certain characters common to both, as well as certain distinctive characters which would enable a practised observer at once to distinguish one from the other. There is thus a mutual adaptation between particular secretions and particular secreting cells. The hepatic cell is adapted, in a manner beyond our comprehension, for the separation of biliary matter, and the renal cells for the separation of urea and the other solid constituents of the urine: and again, the biliary matter and urea, &c., are the materials adapted for promoting the growth, development, and final disappearance and blending with the secretions, of such cells as the hepatic and renal respectively.

The increase in the number of slightly altered epithelial cells in cases of renal disease consequent on scarlatina, is a certain indication that materials not naturally forming a part of the renal secretion are being excreted by the kidney. These materials are doubtless combined with the cells, and their separation from the blood is effected by the growth and development of the cells. The increased quantity of blood in the kidney, and the increased cell-formation, are mutually connected; in like manner, the ascent of the sap and the expansion and development of the leaf-buds are mutually connected and inter-dependent.

The presence of albumen and blood in the urine is obviously a result of the turgid condition and the active congestion of the entire vascular system of the gland. As this condition of the vessels in any of the tissues of the body commonly leads to extravasation of serum or even of all the constituents of the blood into the surrounding parts, so the structure of the kidney, and particularly that of the Malpighian bodies, is obviously such as renders the admixture of blood or serum with the urine a necessary consequence of the before-mentioned condition of the vascular system.

The imperfect elimination of the urinary constituents, their accumulation in the blood and the consequent deterioration of this fluid, are the obvious and necessary consequences of the choking up of the tubes of the kidney, and of

the obstacle thereby offered to the efficient performance of their secretory function. So great may be the interference with the excretory office of the kidney, that the disease may prove fatal within a few days, by the occurrence of coma or of inflammation of one or more internal organs. Under judicious treatment, however, the majority of these cases recover, the noxious matters are effectually eliminated, the vascular congestion and the desquamation of the urinary tubules simultaneously diminish, the cells which were thrown into the tubes are gradually washed out, and the kidney is completely restored to its original, healthy condition.

To the form of renal disease here described as occurring in connection with scarlatina I propose to give the name of "*acute desquamative nephritis*."

The question next arises,—Does this condition of kidney occur in any cases unconnected with scarlatina? A careful observation of several cases during life, and a comparison of the appearances presented by the urine with the condition of the kidney after death, enable me to state with confidence, that a form of renal disease differing in no essential respect, either as regards symptoms or anatomical appearances, from the "*acute desquamative nephritis*" which occurs in connection with scarlatina, is very commonly met with unconnected with scarlatina. A detail of the cases upon which my conclusions are founded would render this communication inconveniently long; I shall therefore content myself with a brief statement of the general results.

In children, by far the most frequent cause of acute desquamative nephritis is scarlatina; in adults, it occurs less frequently as a consequence of scarlatina, but much more commonly as a consequence of other conditions which are known to exert a powerful influence on the general nutrition of the body, as well as on the process of assimilation and of functional integrity in particular tissues and organs.

The first case in which I detected acute desquamative nephritis, unconnected with scarlatina, was in a girl named Eliza Smith, ætat. 21, a patient of Dr. Budd's, in King's

College Hospital. She had suffered much from secondary syphilis, and, at the time of her admission on the 26th Nov. 1845, was very weak and emaciated, had cough with mucous expectoration and night sweats, and had very painful nodes on the shin bones. She soon began to improve under the use of Iodide of Potassium and a nutritious diet. In the early part of December, symptoms of renal disease were first observed; she had frequent vomiting, and on the 16th Dec. the urine was found to be scanty and very albuminous. The day before this, she was seized with pleurisy on the left side. These symptoms continued until the 11th January, when she died. The kidneys presented all the characters of "acute desquamative nephritis," and there was a sero-purulent liquid in the left pleura.

In another case the disease appeared to arise from mental anxiety, combined with insufficient food; and in several others it could be traced to a want of sufficient food, with the addition, in some cases, of bodily fatigue and exposure to wet or cold.

The *Medical Times*, of May 22nd, 1847, contains the report of a very interesting case, evidently of acute nephritis supervening upon the suppression of an extensive eruption of impetiginous eczema. The case occurred in the Hospital Saint Louis, and is thus reported:—"R——, ætat. 27, a porter, was admitted into the hospital on the 10th March last. Some months previously, under the influence of circumstances which remained unknown, a scaly eruption showed itself on the body and limbs: warm-baths were exhibited; the scales fell, and an eruption of impetiginous eczema appeared on the thighs, scrotum, and arms. The eruption was rapidly yielding to a mild antiphlogistic treatment, when, on the 12th April, œdema of the face, intense pain in the lumbar region, and suppression of urine, were observed, together with a considerable degree of dyspnoea and fibrile excitement. In the peritoneal cavity a certain amount of effusion was also detected. The urine, which at first was altogether suppressed, was afterwards secreted, though very scantily, and was found to contain a large quantity of albumen. The

respiration became more and more difficult, although auscultation of the chest and heart betrayed the presence of no physical change; and after three days the patient died. The treatment consisted in venesection on the first day, and afterwards of abundant drinks with nitre and syrup of squills, and of stimulating frictions with croton oil on the region of the loins. Tartar emetic was also exhibited without procuring any relief. On dissection, a small quantity of transparent serum was found in the peritoneum: the kidneys, otherwise healthy in their texture, were slightly injected on their surface: the lungs and heart presented no morbid change, and no alterations were detected in the brain or spinal cord."

I shall have occasion to refer again to the connection between cutaneous and renal disease.

The predisposing cause of the disease in all these cases is the presence, in the system, of abnormal and irritating products, the result of mal-assimilation. The kidney suffers in the manner already described, during the process of excreting these abnormal products, which are often determined to the kidney suddenly and in great quantity by exposure to cold and the consequent impairment of the cutaneous functions; so that it commonly happens that the immediate exciting cause of an attack of acute nephritis, with dropsy and albuminous urine, is exposure to wet or cold: and this is true of the cases occurring in connection with scarlatina, as well as of those unconnected with this disease. It is highly probable that exposure to wet and cold would never produce that form of disease under consideration, if the person so exposed had been previously healthy and well nourished. It is the *quality* of the blood sent to the kidney, and not the *quantity* of this material, which produces the disease in question.*

The next form of inflammatory disease, to which I would

* I am desirous of acknowledging the assistance which I derived from Mr. Simon in making my earliest examinations of the kidney in cases of dropsy after scarlatina. Some later as well as more important and satisfactory observations on the same subject were made conjointly by Dr. Todd and myself. A short account of these observations was given by Dr. Todd

direct attention, is one of great interest and importance. Two drawings by Dr. Westmacott represent the disease in two different stages: one represents a kidney in the earlier stage; the other shows a more advanced stage of the same disease. The kidney is never much enlarged; in the earlier stage the size of the organ is natural, and the structure of the cortical portion appears confused, as if from the admixture of some abnormal product; there is also some increase of vascularity. As the disease advances, the cortical portion gradually wastes, the entire organ becomes contracted, firm and granular, the pyramidal bodies remaining comparatively unaffected even in the most advanced stages: simultaneously with the diminution in size of the kidney there is a decrease of vascularity. These changes occur very gradually: the disease is essentially chronic, having a duration in most cases of many months, and in some even of several years. It is almost confined to persons who are in the habit of partaking freely of fermented liquors; it is very commonly seen in those who have suffered from gout, and is not uncommon in those who, having indulged freely in the use of fermented liquors, have yet never had an attack of gout. It is sometimes, but I believe rarely, met with in those whose mode of life has been strictly temperate and abstemious. The symptoms usually attending the disease are the following:—Dropsy, which

in a clinical lecture published in the Medical Gazette for December 1845. In the same lecture Dr. Todd remarks, "the anatomy of the kidneys in inflammatory dropsy (unconnected with scarlatina) has yet to be investigated. I believe I can furnish a contribution to the subject; but as my examination was made a long time ago, I do not desire to attach great importance to it." Dr. Todd then reports the case of a fine-looking young man, 25 years of age, who, after exposure to cold, had an attack of dropsy with albuminous urine. At the end of a month the patient died under an attack of pleurisy and peritonitis. Dr. Todd thus describes the microscopic appearances of the kidney: "The tubes were enlarged and filled by an abundant epithelial formation, which seemed to distend them; on making a transverse section, the dilated state of the tubes was more conspicuous, and the epithelium could be pressed out of them, leaving only their dilated walls. Several Malpighian bodies were enlarged."

commonly is not excessive, often coming on only in the most advanced stages, and sometimes being entirely absent throughout the entire progress of the disease. The urine is commonly albuminous; it seldom, however, contains a very large quantity of albumen, and sometimes there is no coagulation on the addition of heat or nitric acid. The urine is sometimes high-coloured and scanty, but in most cases it is rather abundant, pale, and of low specific gravity—from 1005 to 1010. In some instances the quantity of urine is much greater than in health, and this increased quantity of urine is secreted by kidneys which are found after death to be contracted to one third of their original bulk. In urine of such low specific gravity there is of course a deficiency of the solid constituents, while the blood, which is much changed and impoverished, contains an excess of these materials.

On a microscopical examination of the kidney, the nature of the above-mentioned changes is very clearly revealed, and at the same time the attending symptoms are satisfactorily explained. My account of these phenomena will be rendered more intelligible if I give the facts and their explanation at the same time.

On placing thin sections of the kidney under the microscope, some of the tubes are seen to be in precisely the same condition as in a case of acute desquamative nephritis; they are filled and rendered opaque by an accumulation within them of nucleated cells, differing in no essential respect from the normal epithelium of the kidney; this increase in the number, and this slight alteration in the character, of the epithelial cells, are the result of the elimination by the kidney of mal-assimilated products, which are being continually developed in these gouty and intemperate subjects, and which are not normal constituents of the renal secretion.

There must evidently be a certain limit to the number of cells which can be formed in any one of the urinary tubes, for although some of the cells escape with the liquid part of the secretion, and so may be seen in the urine, as in a case of acute desquamative nephritis, yet in many of the tubes the

cells become so closely packed that the further formation of cells is impossible, and the process of cell-development and, consequently, of secretion within that tube, are arrested. The cells, thus formed and filling up the tube, gradually decay and become more or less disintegrated. While these changes are going on in the convoluted portions of the tubes, the Malpighian bodies remain quite healthy, the Malpighian capsules for the most part transparent, and the vessels in their interior are perfect. (See Plate VI. fig. 1.) From these vessels, water, with some albumen and coagulable matter, is continually being poured into the tubes; and, as a consequence of this, the disintegrated epithelial cells are washed out by the current of liquid flowing through the tubes, so that, on examining the sedimentary portion of the urine, we find in it cylindrical moulds of the urinary tubes, composed of epithelium in different degrees of disintegration and rendered coherent by the fibrinous matter which coagulates amongst its particles. The appearance of these casts, which are quite characteristic of this form of "chronic desquamative nephritis," is represented in figs. 10, 11 and 12.

There is reason to believe that when the process of cell-development and of secretion have once been arrested, by the tube becoming filled with its accumulated contents, it never recovers its lining of normal epithelial cells; but when the disintegrated epithelium has become washed away from the interior of the tube, the basement membrane may be seen in some cases entirely denuded of epithelium: in other cases a few granular particles of the old decayed epithelium remain (see Plate VI. fig. 2): and again in other instances, the interior of a tube which has been deprived of its proper glandular epithelium is seen lined by small delicate transparent cells, very similar to those which may sometimes be seen covering the vessels of the Malpighian tuft. (See Plate VI. fig. 3.)

It now becomes interesting to ascertain what further change the tube undergoes, after having lost its normal epithelium. It is quite certain that, as a general rule, the Malpighian bodies remain unaffected, both in structure and in

their office of secreting the watery constituents of the urine, until the whole of the disintegrated epithelium has been washed out of the tubes. Of this there are two proofs; the first is the fact of a very long convoluted tube having its contents completely washed out, and its basement membrane left quite naked: this could happen only as a consequence of a current of liquid passing through the tube, and there is no known source of such a current but the Malpighian vessels: the second proof is still more convincing and satisfactory, and it is this,—that a tube may often be seen entirely denuded of its epithelial lining and continuous with a Malpighian body, in the interior of which the vessels are quite perfect.

Now, a tube of this kind deprived of its lining of normal epithelium has manifestly lost its power of separating from the blood the solid constituents of the urine, while, the Malpighian vessels remaining unaffected, the power of secreting water remains. Further, it appears probable not only that the Malpighian body continues to secrete water, but that the whole length of a convoluted tube thus deprived of its proper epithelium, and either remaining naked or lined by delicate nucleated cells, such as those which cover the Malpighian vessels—that the entire length of such a tube becomes a secretor of water, which it abstracts from the portal plexus of vessels on its exterior. This is rendered probable by the appearance of the tube itself, and the probability is still further increased by the fact of the tubes becoming in some cases dilated into cysts, which usually contain a simple serous fluid without any of the solid constituents of the urine.

It has long been supposed that the simple cysts, which are so commonly seen in connection with some forms of renal disease, are in fact dilatations of the urinary tubes. I am not aware that any satisfactory evidence has been adduced in confirmation of this opinion, but there are some facts and arguments which appear to me abundantly sufficient to prove the accuracy of the notion.

1st. The tubes thus denuded of their epithelium are often seen much dilated. I have repeatedly seen them three or

four times exceeding their normal diameter,—in some cases the dilatation is very sudden, so that the tube assumes a globular form, and appears to bulge in the intervals of the fibro-cellular tissue in which the tubes are packed. (See Plate VI. fig. 5.) In some cases, too, the basement membrane appears thickened in proportion to the dilatation of its cavity. Now, this process of dilatation having once commenced, and the lower end of the tube becoming closed by a deposit in its interior or by pressure from without, there is no reason to suppose that the process may not continue until a cyst as large as a pea or a walnut is formed.*

2ndly. But there are other facts which afford a very interesting and remarkable confirmation of this notion. In a case of simple acute or chronic nephritis, the quantity of oil in the *secreting cells* of the kidney is very small; sometimes indeed none can be detected. But it frequently happens that after a tube has been stripped of its secreting cells in the manner before mentioned, an accumulation of fatty matter occurs in its interior, the denuded basement membrane becomes scattered over with separate oil-globules, and these increase in size until they form masses of fatty matter having much the appearance of adipose tissue; and such a mass is frequently washed out from the tube and may be detected in the urine.† This occasional filling of the tube with fatty matter is very interesting, in connection with the

* The precise cause of obstruction may frequently be seen on examination of the tubes about the bases of the pyramids; the tubes which occupy this position are frequently found to be completely obstructed by the epithelial particles which have been washed into them from above, that is, from portions of tubes nearer the Malpighian bodies.

† The appearance of these clusters of oil-globules is so very different from that presented by the *secreting cells* when distended with oil (see Med.-Chir. Trans., Vol. xxix., Plate I.), that their presence in the urine by no means increases the difficulty in the diagnosis between a fat and an inflamed kidney; on the contrary, the detection in the urine of such a mass as is represented in Plate VI. fig. 8, would of itself justify the inference that the kidney from which it had come was in a state of chronic inflammation rather than of fatty degeneration.

fact that in some cases the cysts, which are supposed to be dilated tubes, are also found filled with the same material. In two cases I have found a cyst as large as a hazel-nut quite full of oil, presenting all the characters of that seen in the tubes which have lost their epithelium in consequence of chronic inflammation.

The evidence, then, of the simple serous cysts being dilated tubes is the following:—1st. The tubes are often seen much dilated and thickened. 2nd. As the inner surface of the tubes has the appearance of being endowed with the power of secreting water, so the cysts usually contain a simple serous fluid. 3rd. As an accumulation of oil occasionally occurs in the tubes, so the cysts are in some instances filled with the same material. 4th. *There is no reason to suppose that these cysts have any other origin.* It appears probable that the Malpighian bodies could not become dilated into cysts, because an accumulation of liquid within the Malpighian capsule would necessarily compress and obliterate the vessels of the Malpighian tuft, and so would cut off the further supply of fluid.*

Another change consequent upon the destruction of the cells which line the urinary tubes is, a diminished supply of blood and a gradual wasting of the tube. I have already shown that there must be a close connection between an increased development of epithelial cells and an increased afflux of blood to the part. This is well seen in a case of acute desquamative nephritis, and, *vice versâ*, a more or less complete destruction of the epithelial cells will be attended by a corresponding diminished afflux of blood and a consequent atrophy of the part affected. In every kidney which has been the subject of chronic inflammation, there may be seen tubes contracted in different degrees as a consequence of

* Additional evidence as to the nature of these cysts, and their relation to the normal tissues of the kidney, is afforded by some remarkable preparations of diseased kidney in the Pathological Museum of King's College. See the Author's Catalogue of the Museum, Nos. 871, 872, 873, 874, and 875.

the destruction of their epithelial lining: in some instances the basement membrane becomes folded, and presents an appearance not very unlike white fibrous tissue. As a consequence of this wasting of successive sets of tubes there is a gradual diminution in the bulk of the cortical portion of the kidney, until at length the entire organ becomes small, contracted and granular. When a thin section of a kidney thus atrophied is placed under the microscope, there may be seen an abundance of fibrous tissue, and this has often been described as new fibrous tissue developed during the progress of the disease, whereas it is in reality nothing more than the atrophied remains of the basement membrane of the tubes, with the healthy fibrous tissue arranged in the form of a net-work in which the tubes are packed, and which now appears more abundant in consequence of the wasting of the tubes.*

It has already been stated that the Malpighian bodies are unaffected in the progress of this disease, and this is true in so far as they remain for the most part free from any deposit or accumulation in their interior; but they must necessarily be affected by the changes occurring in other parts of the organ. Thus the destruction of many of the Malpighian bodies is a necessary consequence of the simultaneous wasting of the vessels and tubes which occurs in the advanced stages of chronic nephritis: and during the progress of the disease, the vessels of the Malpighian tuft will be in a state of more or less active congestion, in proportion to the rapidity of secretion and of cell-development in the tubes; and one consequence of this congestion of the Malpighian bodies will be the escape of serum into the tubes and the mixture of albuminous matter with the urine. The quantity of albumen in the urine will be great in proportion as the disease approaches in activity to that form which I have called "acute desquamative nephritis." When the disease is chronic and inactive there may be no albumen in the urine, or, it may be present in quantities so small as not to be detected by the ordinary chemical tests. In such cases, as indeed for the

* See Plate I. in the 29th vol. of the Med.-Chir. Transactions.

accurate discrimination of all forms of renal disease, the microscope will be found an invaluable aid. It must be remembered that the essential change in this disease is a destruction of the epithelial cells in the manner already described; the best evidence of this change being in progress is, the presence in the urine of moulds of the urinary tubes, composed of more or less disintegrated epithelium; and such evidence I have repeatedly obtained when no albumen could be detected by the ordinary heat and nitric acid tests.

A sufficient explanation has already been given of the small quantity of the saline constituents excreted by the kidneys in cases of chronic nephritis. It is manifest that if the epithelial cells are the agents by which the solid constituents of the urine are separated from the blood, a deficient excretion of these materials will be a necessary consequence of the greater or less destruction of the epithelial cells.

Another remarkable phenomenon in some of these cases admits, I believe, of an equally simple explanation: I allude to the large quantity of the watery part of the urine not unfrequently excreted by kidneys which are found after death to be very much wasted and contracted. It is by no means unusual to find patients with chronic nephritis passing 60 or 80 oz. of urine in 24 hours. What has already been said of the Malpighian bodies remaining healthy, and of the condition in which some of the tubes remain after being deprived of their epithelium, is a sufficient *anatomical* explanation of the fact, and the following appears to be the *physiological* explanation:—In health there is, within certain limits, a pretty constant relation between the quantity of solids excreted by the epithelial cells and the amount of water poured out by the Malpighian bodies. The relation is not, of course, very precise and constant, for, if it were so, the urine would invariably have the same density. There are many and various disturbing influences; but it may be stated, as a general rule, that the convoluted tubes and the Malpighian bodies act in concert, so that if more solid matter is excreted by the cells, a correspondingly increased amount of water is poured out from the Mal-

pighian bodies. In diabetes, for instance, the amount of water increases in proportion to the increase in the quantity of sugar. The cause of the increased flow of water in diabetes may be one of two conditions: 1st. It may be that the quantity of sugar *in the blood*, circulating through the Malpighian vessels, is the stimulus which excites these vessels to pour out water; or, 2nd, it may be the sugar in the *secreting cells* of the tubes which, as it were by a reflex action, excites the flow of water from the Malpighian vessels. Whichever of these two explanations be the correct one, the conditions for both exist in a case of chronic nephritis. If the presence of the solid urinary constituents in the blood be the cause of the phenomenon in question, it is well known that, as a consequence of renal disease, these materials are retained in such quantity as to be always injurious and frequently fatal to the patient. If, on the other hand, the Malpighian bodies are stimulated to secrete water by the presence, in the tubes, of the cells with their solid contents, it has already been shown that, as a consequence of chronic nephritis, these cells accumulate in the tubes in such abundance, that they may be supposed to excite the Malpighian bodies to action, in a manner not unlike the excitation of the lachrymal gland by a foreign body on the conjunctiva.*

Before leaving the subject of chronic inflammation of the kidney, I would refer to the case communicated to this Society by Mr. Busk, and published in the last volume of the Transactions, as a good instance of the form of disease under consideration. Mr. Busk is inclined to attribute the disease in that case to "the double duty the gland was called upon to perform," in consequence of the congenital deficiency of the other kidney. I should suppose the disease to have been the

* During an acute attack of nephritis, the aqueous portion of the urine is scanty on account of the vascular congestion and the consequent retardation of the circulation; but when the disease subsides and the congestion diminishes, the secretion often becomes abundant, and continues so until the renal tubes are thereby cleared of the morbid products which had accumulated within them.

result of the excretion, by the kidney, of abnormal and irritating products connected with the "occasional attacks of painful swelling of the foot, which were of short duration and considered to be of a gouty nature."

It must never be forgotten that these diseases are essentially connected with changes in the secreting cells; that, so long as the materials to be excreted are normal, the cells retain their healthy character, and an increased amount of normal excretion produces merely an increase in the size of the entire gland, without any change in the constitution of its several parts; while an unnatural condition of the excreted products is attended by some corresponding alteration in the character of the secreting cells.

Before concluding this communication on the inflammatory diseases of the kidney, it appears desirable to allude very briefly to the subject of my last paper:—viz. "Fatty Degeneration of the Kidney,"—my object being to show how essentially distinct are the two forms of disease; and at the same time to explain the manner in which they are sometimes combined. The observations which I have to make on this subject may be considered as an

APPENDIX

To a Paper on the Minute Anatomy and Pathology of Bright's Disease, &c., published in the Society's Transactions, Vol. xxix.

For some months past I have been aware that fatty degeneration of the kidney occurs in two distinct forms. The first form is represented in a drawing made for me by Mr. Brinton. The disease occurred in the person of Susan Smith, æt. 30, who died in the King's College Hospital, under the care of Dr. Budd, to whose kindness I am indebted for notes of the case. She had general dropsy, and her urine was very albuminous. The kidneys were in a state of "simple fatty degeneration;" they were large, smooth, soft and mottled, and were scattered over with

hæmorrhagic spots. On a microscopical examination there was found no increase in the number of epithelial cells, nor inflammatory products of any kind, but simply a great accumulation of oil-globules in the epithelial cells; and consequently a filling and distention of the urinary tubules which contain the cells. The albuminous condition of the urine, and the hæmorrhagic spots on the kidney, were doubtless the result of passive congestion of the Malpighian vessels, consequent on compression of the portal plexus by the distended urinary tubes.

In this simple fatty degeneration of the kidney all the tubes become almost uniformly distended with oil. In a slight degree and in the earlier stages, it is often found after death, in cases where there is no reason to suspect that it has been productive of any mischief during life: it is not until the fatty accumulation has attained a certain amount that the functions of the kidney are interfered with. It is this form of fatty degeneration of the kidney which occurs in animals, as a consequence of confinement in a dark room. In the human subject, although in the earlier stages it is a very common occurrence, yet in the more advanced stages it occurs less frequently than the *second form of fatty degeneration*. This form of the disease is represented in the 5th figure of Dr. Bright's 3rd Plate, as well as in the 1st, 2nd, 5th, and 6th figures of Rayer's 8th Plate. The cortical portion of the kidney, to use the words of Dr. Bright, is soft and pale, and interspersed with numerous small yellow opaque specks. The kidney is generally enlarged; sometimes it is even double the natural size. In some cases the cortical portion is somewhat atrophied and granular, but neither in this nor in the first form of fatty degeneration of the kidney does that extreme wasting with granulation occur, which is so frequent a consequence of chronic nephritis.

On a microscopical examination the convoluted tubes are found filled in different degrees with oil, some tubes being quite free while others are ruptured by the great accumulation in their interior. The opaque yellow spots scattered

throughout the kidney are neither more nor less than convoluted tubes distended, and many of them ruptured by their accumulated fatty contents; just as the red spots are found to be convoluted tubes filled with blood. The cells which contain the oil are for the most part smaller, more transparent, and less irregular in their outline than the ordinary healthy epithelium; they are increased in number, and many of them are so distended with oil as to appear quite black. In parts of the same kidney, there may commonly be seen some of the appearances already described as indicative of desquamative nephritis. This form of disease is very commonly combined with fatty degeneration of the liver, but less frequently than is the first form of fatty degeneration of the kidney.

It was not until very recently that I could give an explanation of the appearances here described, and of the difference between this and the first form of fat kidney. At present I have under my care, at the Public Dispensary, a patient, the progress of whose case has afforded me the light I had for some time been in search of. I will give so much of this man's history as will suffice to render my explanation intelligible.

John St. Ledger, æt. 49, a billiard-marker, until the commencement of the present year has always led a very irregular and intemperate life. About eight years ago he had an attack of general dropsy, with very scanty and high-coloured urine. He was bled from the arm; and in about six weeks he recovered completely. He remained well until about four years ago, when he had a similar attack from which he recovered in about a month: from this time he continued well until the commencement of the present illness, which he thus accounts for:—During the period of Lent in the present year he fasted, i. e. during four days in the week he took only one meal a-day; this meal was composed of fish with milk and potatoes; during the remaining three days he took animal food as usual, perhaps rather in excess. Under this mode of living he found himself becoming thin

and weak, and towards the end of Lent he had lost flesh considerably, and was very dyspeptic and flatulent after his meals. On Easter Monday, April 5th, he felt drowsy and had muscular pains; the next day he had dropsical swelling, and the urine was very scanty. He continued to get worse until Monday, April 12th, when he applied at the Dispensary. There was then slight general dropsy, headache and drowsiness; the urine was scanty, high-coloured and very albuminous. On a microscopical examination I found in it all the appearances which are characteristic of simple acute desquamative nephritis—i. e. there were blood-corpuscles, fibrinous casts of the tubes, and epithelial cells in great numbers. During the first few days he was much benefited by cupping, warm-baths, purging and diaphoretics.

A careful microscopical examination of the urine was made almost daily; the characters remained the same until April 29th, when it was found that many of the epithelial cells contained a considerable number of oil-globules; and from that time to the present he has continually passed fibrinous casts and epithelial cells, many of which are completely distended with oil-globules; and in proportion as they become filled with oil they appear to lose their angular outline, and become transparent and globular or oval. At the present time the urine is highly albuminous, and the poor man is gradually becoming more pallid and emaciated.

Here then is an explanation of the second form of fatty degeneration of the kidney, the peculiarities of which result from a nephritic condition of the organ, dependent on the presence of some irritating material in the blood being associated with a tendency to fatty degeneration; this tendency resulting from the presence in the blood of mal-assimilated fatty matter. The nephritic condition is manifested by an increase in the number of epithelial cells; the tendency to fatty degeneration, by a filling of many of these with oil. Although the two conditions are combined in this and in similar cases, it must be remembered that they are essentially distinct in their nature and origin. Each cell which escapes

from the kidney carries with it a portion of the morbid material. The oil is in the form of visible globules, while the cells which contain no oil doubtless contain some other material which is invisible, or less readily seen than the oil-globules.

That the oil is an excretion, is to a certain extent proved by an observation which I have recently made in the case of a girl named Amelia Robinson, at present in King's College Hospital under the care of Dr. Todd. This patient has dropsy with albuminous urine, dependent on acute nephritis; the very disordered state of her nutrition is clearly shown by the materials contained in her urine. These are, in addition to albumen and blood, triple phosphates, phosphate of lime and oxalate of lime. There are many globular and oval cells exactly similar to those which are commonly found to contain oil, filled in different degrees with the octohedral crystals of oxalate of lime. (See Plate VI. fig. 9.) It cannot be doubted that the oxalate of lime is excreted by these cells, and that its presence in the urine is a consequence of disordered general nutrition, and not of any local disease in the kidney; and there is as little reason to doubt that the presence of oil in the urine is the result of an analogous disorder.

I have now distinguished and described four conditions of the kidney :

- 1st. Acute desquamative nephritis.
- 2nd. Chronic desquamative nephritis.
- 3rd. Simple fatty degeneration, and
- 4th. A combination of fatty degeneration with desquamative nephritis.*

In all these diseases the morbid materials are deposited in the urinary tubules, from which portions of them become

* The two forms of inflammatory disease above mentioned are not the only diseases of an inflammatory nature to which the kidney is liable as a consequence of constitutional disorder. The author has notes of cases, in some of which the morbid material deposited in the kidney and eliminated with the urine has been chiefly pus, while in another and a distinct class of cases it has been chiefly blood. As an example of the latter

washed out, and thus mingled with the secretion. The diagnosis of each of these conditions of the kidney, during the life of the patient, is a matter of the greatest importance with reference to prognosis and treatment, and the diagnosis may be made with ease and certainty by a microscopical examination of the urine.

It must be remembered that the materials in question are all, with the exception of free oil-globules, of greater density than the urine, so that in a short time they fall to the bottom of the vessel in which the fluid is contained. In collecting the urine for examination, care must be taken to obtain the sedimentary portion; the upper part of the liquid may be poured off, and the last three or four ounces should be shaken up and taken for examination.

When the quantity of material is small, as often happens in cases of chronic nephritis, the examination is much facilitated by placing the urine in a conical glass, shaped like an ale-glass; after standing a short time, the material we are in search of collects within a small space at the bottom of the vessel: with a pipette a few drops may be taken from the lower part of the liquid, placed in a small cell, then covered with a thin plate of glass and examined with a power of about 200 diameters. In the majority of cases an examination occupying only two or three minutes will afford information, as to the condition of the kidney, not less certain nor less valuable than that obtained by a physical examination of the chest in cases of pulmonary and cardiac disease.

If the account here given of these diseases be a faithful and a correct one, without doubt it throws great light, not merely on their pathology but also on their treatment. It teaches us that these morbid conditions of the kidney do not

form of disease he would mention cases of hæmaturia induced by the administration of oil of turpentine or cantharides; and he has observed several cases in which the exciting cause has been of a different nature. He will take an early opportunity of bringing these observations before the public, and hopes to show that he does not over-estimate their pathological and practical importance.

originate in the organ itself, but rather that they are the local manifestations of a more general constitutional disorder.

The pathological changes which the kidney undergoes are such as it is liable to in the performance of its physiological duty, that, namely, of separating from the blood materials, the retention of which would interfere with the normal and healthy condition of that fluid.

In the treatment of these diseases two indications must be kept constantly in view. These are, first,—To prevent the further formation or development of those products, the excretion of which by the kidney is productive of serious structural changes; and second,—To relieve the kidney as much as may be of its excretory duty, by exciting to action other eliminating organs—as, for instance, the skin and bowels.

With reference to the mutual connection between the skin and the kidneys, the following general principles appear worthy of attention:—First, When the kidneys are suffering in consequence of having to excrete abnormal products, we may often with safety and advantage relieve these organs by exciting the skin to an increased amount of excretory work. On the contrary, when, in consequence of an abnormal condition of the blood, the skin is the seat of disease, the greatest care and caution are required in the administration of cantharides and other diuretic medicines; the danger being, that the *materies morbi* may by these means be determined to the kidneys, and that the cure of a trifling cutaneous disease may be accomplished at the risk of exciting a serious and destructive renal disease.

Second,—When cerebral disease supervenes upon the suppression of a cutaneous eruption, it is probable that this occurs through the intervention of renal disease, and not as a consequence of the direct transfer of disease from the skin to the brain or its membranes.

It has been too much the custom to administer medicines for the purpose of stimulating the kidneys, in all cases in which these organs are supposed to be in a state of functional inactivity. There are certain materials derived both from

the organic and the inorganic kingdom, the administration of which to a person in health is constantly followed by an increased flow of urine, and at the first view of the matter, it appears natural to suppose that the same materials would be equally efficacious in increasing the quantity of urine when the secretion has become scanty in consequence of renal disease. A very small amount of physiological knowledge, however, is sufficient to explain the universally acknowledged uncertainty, or rather the almost certain want of success, attending the administration of diuretic remedies in all cases of renal disease. The most certain diuretics are the normal solid constituents of the urine—experiment sufficiently shows this. Dr. Todd relates (in a clinical lecture published in the Medical Gazette for 1845) that “he once injected half a drachm of urea into the vein of a dog, and the only effect produced was an excessive secretion of urine. The place where the dog was kept was literally flooded in an hour or two by the frequency and quantity of his micturition.” In almost every case of renal disease these natural diuretics accumulate in the blood, not on account of any mere functional inactivity unconnected with organic change, but because the secreting structure of the kidney is more or less completely destroyed. Under such circumstances, the administration of medicines which would be excreted by a healthy kidney is like adding to the load on a porter’s back, since it increases the demand upon the labour of the kidney, without in any degree adding to its powers of performance. There is reason to believe that in cases of this kind, and more especially perhaps in cases of chronic nephritis, the only safe and useful diuretic is pure water.

EXPLANATION OF PLATE VI.

This plate illustrates Dr. Johnson's paper on the Inflammatory Diseases of the Kidney.

- Fig. 1. Section of a portion of inflamed kidney. The tubes appear as if divided into distinct globular and oval portions; this appearance results from the manner in which the tubes are packed in the meshes of the fibrous tissue, so as to be concealed where they are crossed by the fibrous tissue, and visible in the intervals. The tubes are rendered opaque by an accumulation of epithelium, the outline of the cells being invisible on account of their crowded condition. A Malpighian body in the centre of the mass appears transparent and healthy. (See p. 175. Magnified 200 diameters.)
- Fig. 2. Section of a portion of kidney, showing the tubes deprived of their epithelium by "chronic desquamative nephritis." The appearance of the tubes is very similar to that of globular and oval transparent cysts; the explanation of this appearance is given above. (See p. 175. Magnified 200 diameters.)
- Fig. 3. Section of a portion of kidney, showing the tubes lined by delicate transparent cells. (See p. 175. Magnified 200 diameters.)
- Fig. 4. Portion of the basement membrane of a tube deprived of its epithelium, and contracted by its elasticity into an irregular globular form after being detached from the surrounding tissues. (Magnified 200 diameters.)
- Fig. 5. Portion of a tube much dilated, and bulging in the intervals of the fibrous tissue: the cut extremity of the tube is seen at *a*. (Page 177. Magnified 200 diameters.)
- Fig. 6. Portion of a tube much dilated, and divided by septa which correspond with the rings of fibrous tissue in the microscopic specimens. From preparation No. 871 in the King's College Museum; natural size.

- Fig. 7. Includes, *a a*, fibrinous casts of the urinary tubes entangling epithelial cells and blood-corpuscles; *b b*, free epithelial cells; and *c c c*, crystals of lithic acid from the urine in a case of "acute desquamative nephritis." (Page 168. Magnified 200 diameters.)
- Fig. 8. A mass of oily matter from the urine in a case of "chronic desquamative nephritis." (Page 177. Magnified 200 diameters.)
- Fig. 9. A cell containing octohedral crystals of oxalate of lime from the urine. (Page 186. Magnified 400 diameters.)
- Figs. 10, 11 and 12. Casts of the urinary tubes, composed of fibrinous matter and disintegrated epithelium from the urine, in a case of "chronic desquamative nephritis." (Magnified 200 diameters.)
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For a note, having reference to the foregoing papers of Mr. Simon and Dr. Johnson, the reader is referred to the close of the volume.

[*From Transactions of the Medico-Chirurgical Society, Vol. xxx.*]

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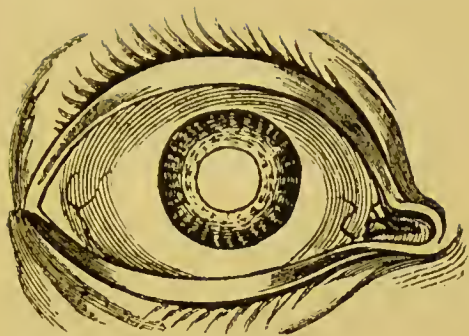


Fig. 1.—The Eye as it appears affected with Cataract.

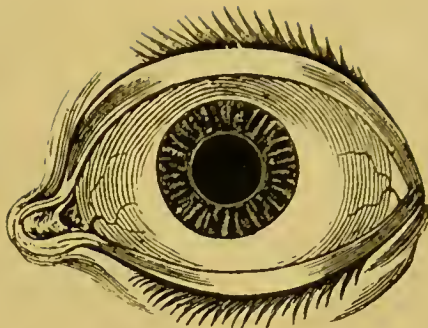


Fig. 2.—The Natural Eye magnified.

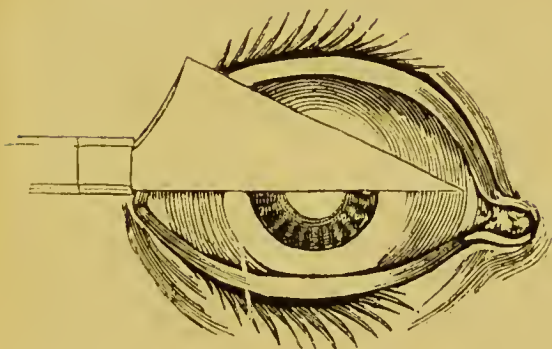


Fig. 3.—The operation for extraction of the Cataract.

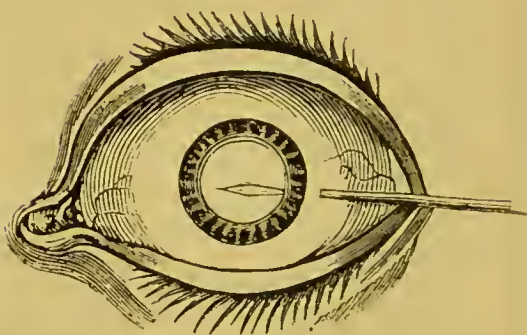


Fig. 4.—The operation for solution, by division of the Lens and its Capsule, by means of the Needle.

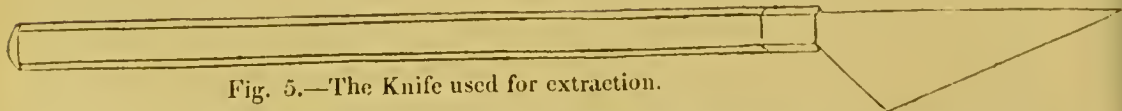


Fig. 5.—The Knife used for extraction.

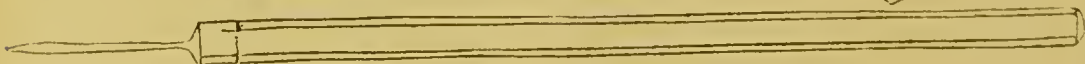


Fig. 6.—The Needle used for the operation of solution.

